

Rayat Shikshan Sanstha's
Yashwantrao Chavan Institute of Science,
Satara
(Autonomous)

Syllabus Under Autonomy
For
B. Sc. II (Botany)

Academic Year 2019 – 2020

Rayat Shikshan Sanstha's

Yashwantrao Chavan Institute of Science, Satara
(Autonomous)

Syllabus for Bachelor of Science (B. Sc.) Part – II

1. TITLE: **Botany**
2. YEAR OF IMPLEMENTATION: **2019 – 2020**
3. DURATION: **01 year**
4. PATTERN: **CBCS Semester**
5. MEDIUM OF INSTRUCTION: **English**
6. STRUCTURE OF COURSE:
1) FIRST SEMESTER (NO. OF PAPERS – 02)

Sr. No.	Subject Title	Theory					Practical	
		Paper No. & Paper Code	Title of Paper	No. of lectures per week	Credits		No. of lectures Per week	Credits
1.	Botany	Paper V: BBT 301	Systematics and Anatomy of Angiosperms	6	4	Practical Paper – III BBP303	8	4
		Paper VI: BBT302	Plant Physiology					

2) SECOND SEMESTER (NO. OF PAPERS – 02)

Sr. No.	Subject Title	Theory					Practical	
		Paper No. & Paper Code	Title of Paper	No. of lectures per week	Credits		No. of lectures Per week	Credits
1.	Botany	Paper VII: BBT 401	Ecology and Environment	6	4	Practical Paper – IV BBP 403	8	4
		Paper VIII: BBT 402	Plant Metabolism					

3) Structure and titles of papers of B. Sc. Course

B. Sc. II Semester I

Paper V: Systematics and Anatomy of Angiosperm

Paper VI: Plant Physiology

Botany Practical III: Practical's based on Theory Paper V and VI

B. Sc. II Semester II

Paper VII: Ecology and Environment

Paper VIII: Plant Metabolism

Botany Practical IV: Practical's based on Theory Paper VII and VIII

4) OTHER FEATURES:

A) LIBRARY:

Reference books, Text books, Journals, Periodicals available in Institute and Departmental Library. (Separate reference lists are attached along with the respective course syllabus)

B) SPECIFIC EQUIPMENTS:

a) Computer, LCD projector, Visualizer, Smart Board

b) Laboratory Equipments:

1. Microscope with digital camera
2. Digital weighing balance
3. pH meter

4. Microtome
5. Autoclave
6. Hot Air Oven
7. Incubator
8. Refrigerator
9. Stereo zoom microscope
10. Dissecting microscope

7. Evaluation Structure for B. Sc. II

Semester III

	ESE	Internal Exam		Practical			Submission	Total
		ISE-I	ISE-II		Exam	Journal	Seminar + Student Performance	
Paper V	30	5	5	Practical-III(A)	25	5	5	150
Paper VI	30	5	5	Practical IV(A)	25	5	5	

Semester IV

	ESE	Internal Exam		Practical			Submission	Total
		ISE-I	ISE-II		Exam	Journal	Industrial visit/Educational Tour + Student Performance	
Paper V	30	5	5	Practical-III(A)	25	5	5	150
Paper VI	30	5	5	Practical IV(A)	25	5	5	

Rayat Shikshan Sanstha's

Yashavantrao Chavan Institute of Science, Satara (Autonomous)

Syllabus introduced from June 2019

Bachelor of Science (B. Sc.) Part – II: Botany

Semester III

Theory Paper V: BBT 301- Systematics and Anatomy of Angiosperms

Learning objectives:

1. To impart the basic knowledge of different aspects of angiosperm systematics.
2. To impart basic knowledge about rules of botanical nomenclature.
3. To impart the basic knowledge of different tissue systems and their uses in plants.
4. To impart basic knowledge of plant anatomy.

Total Lectures 45

UNIT I: Introduction to Plant Systematics

(12)

Definition, need, objectives, importance, scope of taxonomy and systematics; Aspects of taxonomy (Identification, nomenclature, classification); Systems of classification; Bentham and Hooker System of Classification (Broad outline, Merits and Demerits).

UNIT II: Botanical Nomenclature

(11)

ICN- Principles and important rules; Binomial nomenclature, generic names and specific epithets; Herbarium; Botanic gardens (concept of lead botanic garden); Study of families – Umbelliferae (Apiaceae), Cucurbitaceae, Rubiaceae, Amaranthaceae, Commelinaceae, Poaceae.

UNIT III: Tissues and Tissue System

(11)

Tissues (Permanent and Meristematic):

Meristem: Introduction, Characteristics, Classification based on position, Theories of structural development of Meristem – Apical Cell Theory, Histogen Theory and Tunica Corpus Theory; Permanent Tissues: Simple Tissues- Parenchyma, Collenchyma, Sclerenchyma; Complex tissues – Xylem, Phloem; Types of Vascular Bundle.

Tissue Systems:

Epidermal Tissue System, Mechanical Tissue System, Secretary Tissue System.

UNIT IV: Primary and Secondary structure of Plant Body (11)

Primary structure of monocotyledon and dicotyledon root, stem and leaf; Normal secondary growth in dicotyledon root and stem; Periderm, lenticel and growth rings with their significance; Anomalous secondary growth in *Bignonia* (Dicot) and *Dracaena* (Monocot) stem

Learning Outcomes:

1. The students learn to explain morphological and anatomical features of angiosperm.
2. The students learn to define concepts regarding systematics of angiosperm and identification of plants in field.
3. The students learn to apply the rules of botanical nomenclature in the field.
4. The students learn to write answers and brief notes about plant diversity of phanerogams.

References:

1. Singh G 2000. Angiosperm systematics: Theory and Practice. S. Chand Publications, New Delhi (Unit I, II, III)
2. Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants Columbia University Press, New York. (Unit I)
3. Cronquist, A. 1988. The Evolution and Classification of Flowering Plants (2nd ed.) Allen Press, U.S.A. (Unit I)
4. Davis, P. H. and V. H. Heywood 1991. Principles of Angiosperm Taxonomy. Today and Tomorrow Publications, New Delhi. (Unit I)
5. Naik, V. N. 1984. Taxonomy of Angiosperms. Tata McGraw-Hill Publication Co. Ltd. New Delhi (Unit II)
6. Lawrence George H. M. 1951 Taxonomy of Vascular Plants. Oxford and IBH Publ. Co. Pvt. Ltd. New Delhi. (Unit II)
7. Hutchinson, J. 1959. Families of Flowering plants. (Unit II)
8. Easau K, 1962: Plant anatomy – anatomy of seed plants. (Unit III, IV)
9. Fahn A, 1969: Secretary Tissue system (Unit III, IV)
10. Masueth JD, 1936: Plant anatomy (Unit III, IV)

11. Cutter EG, 1971: Plant Anatomy (Unit III, IV)
12. Emmes EJ, Danials MC, 1947: An introduction to plant anatomy. (Unit III, IV)
13. Vashista PC, Plant Anatomy. Pradip Publications, Jalandhar (Unit III, IV)
14. Pandey BP, Plant Anatomy. S. Chand & Company, LTD. Ram Nagar, New Delhi (Unit III, IV)
15. Datta AC, Botany for Degree Students. Press-Delhi, Bombay, Madras (Unit III, IV)

Theory Paper VI: BBT 302-Plant Physiology

Learning Objectives:

1. To impart the basic knowledge of different plant water relationships.
2. To impart the basic knowledge aspects of plant nutrition.
3. To impart the basic knowledge of photosynthesis.
4. To impart the basic knowledge of processes involved in growth and development in plants.

Total Lectures 45

Unit I Plant water relationship

(11)

Introduction, Structure and properties of water, Forms of water in soil; Physiological importance of water; Water transport processes (Mechanism of water absorption: active and passive absorption theories, water transport through xylem and tracheids); Transpiration: Definition, Types of transpiration, Mechanism of stomatal movement, Starch-sugar hypothesis, Factors affecting transpiration, Significance of transpiration, anti-transpirants; Ascent of sap – theories of Ascent of sap

Unit II Mineral nutrition

(11)

Introduction; Essential nutrients (Macro and Micronutrients); Mineral nutrient uptake - Passive uptake (Diffusion), Active uptake (Carrier Concept); Mineral deficiencies and plant disorders; Treating nutritional deficiencies; Effect of excess minerals in soil on plant growth

Unit III Photosynthesis

(12)

Introduction; history and significance; Light, photosynthetic pigments - (Chlorophylls, Carotenoids and Phycobilins); Mechanism of photosynthesis: a) Light reaction - Photolysis of water, Photosystem I and II, Photophosphorylation - Cyclic and Non-cyclic; b) Dark reaction: C₃, C₄ and CAM pathways of carbon fixation.

Unit IV Growth and development

(11)

Growth: Definition, Region of growth, Phases of growth, growth curve, Grand period of growth; Plant growth regulators: Discovery, site of synthesis, Physiological (Practical applications) roles of growth regulators – Auxins, Cytokinins, Gibberellins, Ethylene and Abscisic acid.

Learning Outcomes:

1. The students learn about the processes involved in water uptake and utilization in plants.

2. The students learn the role of minerals in plants.
3. The students learn the basics of the processes involved in photosynthesis.
4. The students learn the mechanisms of growth and development in plants.

References:

1. Hopkins, W. G. 1995. Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA. (Unit I)
2. Salisbury, F. B. and Ross, C. W. 1992. Plant Physiology. (4th edition). Wadsworth Publishing Co., California, USA. 19 (Unit I, II, III, IV)
3. Taiz, L. and Zeiger, E. 1998. Plant Physiology. (2nd edition) Sinauer Associates, Inc., Publishers, Massachusetts, USA. (Unit I, II, III, IV)
4. Grewal R.C. – Plant Physiology. Campus Books International 483/24, Prahiad street Ansari Road, Daryaganj, New Delhi – 110002. (Unit I, III)
5. Jain V.K. Fundamentals of Plant Physiology. S. Chand & Company Ltd. Ramnagar, New Delhi – 110055. (Unit I, III, IV)
6. Verma V. Text Book of Plant Physiology. Emkay Publications., B-19, East Krishna Nagar, Delhi-1100051. (Unit II)
7. Bidwell, R.G.S. 1974. Plant Physiology. Macmillan P ub. Co., N.Y. (Unit III)
8. Hopkins, W. G. 1995. Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA. (Unit III)
9. Pandey, S.N. (1991): Plant Physiology, Vikas Publishing House (P) Ltd., New Delhi, India. (Unit IV)

Practical Paper III: BBP 303- Practicals based on Theory Paper V and VI

Learning Objectives:

1. To give practical knowledge to students about identification of plants around them.
2. To give the practical knowledge about morphological and anatomical variations in plants.
3. To participate students in experiential learning with these practicals.

Practicals

Group A based on Paper V

1. Study of shoot and root apex by permanent slides.
2. Study of simple tissues and complex tissues.
3. Study of primary structure of dicot and monocot root and stem.
4. Study of normal secondary growth in dicot stem (*Annona/ Moringa / Sunflower*) by double stained preparation.
5. Study of anomalous/abnormal secondary growth in *Bignonia* and *Dracaena* by double stained preparation.
6. Study of Epidermal tissue system.
7. Study of Secretary tissue system.
- 8-10. Study of plant families with respect to morphological characters, reproductive character, floral formula, floral diagram and classification as per Bentham and Hookers system – Umbelliferae (Apiaceae), Cucurbitaceae, Rubiaceae, Amaranthaceae, Commelinaceae, Poaceae

Group B based on Paper VI

11. Study of stomatal and cuticular transpiration by cobalt chloride paper method.
12. Study of role and deficiency symptoms of P, K, Ca, Mg.
13. Estimation of Chlorophylls by Colorometric / Spectrophotometric method.
14. Separation of photosynthetic pigments by paper chromatography.
15. Study of Kranz leaf anatomy in C₄ plants.
16. Analysis of vegetative growth (any suitable method).
17. Effect of different concentrations of Auxins (IAA) and Gibberlic acid (GA) on seed germination (any suitable seeds).

18. Study of evolution of oxygen during photosynthesis.
19. Determination of sugar percentage by hand refractometer.
20. Study of permeability of plasma membrane by using different concentrations of organic solvent.

Learning Outcome:

1. Student shall know the anatomical features (tissue systems, normal secondary growth, abnormal secondary growth) of plants.
2. Student shall learn to describe the plants and identification of plant families.
3. Students will be able to learn the effect of plant growth regulators on plants growth.
4. Students will be able to learn the different physiological processes.

Books Recommended:

1. Bendre A (2010) Practical Botany, Rastogi Publications
2. Pande BP, Modern Practical Botany, Vol. I, S Chand Publishers
3. Pande BP, Modern Practical Botany, Vol. II, S Chand Publishers
4. Wallis CJ (1966) Practical Botany for Advanced Level and Intermediate Students (5th Ed.), William Heinemann Medical Books Ltd.
5. Lawrence George H. M. 1951 Taxonomy of Vascular Plants. Oxford and IBH Publ. Co. Pvt. Ltd. New Delhi.
6. Singh G 2000. Angiosperm systematics: Theory and Practice. S. Chand Publications, New Delhi.

Semester IV

Theory Paper VII: BBT 401- Ecology and Environment

Learning objectives

1. To make students aware about the concepts of ecology & advanced environmental science.
2. To understand the inter-relationships between the animate and inanimate world.
3. To make the students aware about phytogeographical zones of India, biodiversity and sustainable development
4. To understand the concept of Bioremediation and its applications.

Total Lectures 45

Unit 1: Ecological Factors and Adaptations

(12)

Introduction, Definition and Scope of Ecology; Ecological Factors: Edaphic factors: Soil- Origin and formation, Composition, soil profile. Climatic factors: Light and Temperature as ecological factors; Ecological Adaptations: Ecological adaptations in Hydrophytes, Xerophytes, Epiphytes and parasites

Unit 2: Plant Communities and Succession

(12)

Plant Communities: introduction, general characters, forms and structure, Raunkier's life forms; Plant Succession: characters, process and types – Hydrosere, Xerosere.

Unit 3: Ecological pyramids and phytogeography

(11)

Ecological pyramids- Number, Biomass and Energy with suitable example; Phytogeographical regions of India

Unit 4: Phytoremediation

(10)

Concept and scope; Types of remediation (bioaccumulation, rhizofiltration, rhizoextraction); Phytoremediation of dyes, chemicals and heavy metals

Learning outcomes

1. Student explains the basic terms and issues in the field of ecology and environmental protection.
2. Describes the relations and interactions between biotic and abiotic components of the environment.

3. Presents the causes and consequences of a biological imbalance in the ecosystems.
4. Indicates the need for biological monitoring of the environment and the possibility of using bio-indicators in the assessment of the environment
5. Students show a negative impact of human pressure on the natural environment.
6. Student Accepts concern for the natural environment.
7. Seeks to implement the basic principles of sustainable development.

References:

1. Ambasht RS (1990) Plant Ecology (Unit I)
2. Krens CJ, Harper and Row (1978) Ecology: The experimental analysis of distribution and abundance. (Unit I)
3. Lieth HFW (1978) Patterns of primary production in the biosphere. (Unit I)
4. Agarwal SK (1992) Fundamentals of Ecology. (Unit I, III)
5. Bradbury IK (1990) The Biosphere (Unit I)
6. Grisms JP et al., (1988) Comparative Plant Ecology. (Unit II)
7. Kershaw KS (1964) Quantitative and dynamic ecology. (Unit II)
8. Kormondy EJ (1966) Concept of ecology. (Unit II)
9. Krebs CJ (1978) Ecology. (Unit II)
10. Misra KC (1989) Manual of plant Ecology. (Unit I, III)
11. Odum EP (1996) Fundamentals of Ecology. 3rd Ed. (Unit I, III)
12. Kormondy EJ (1966) Concept of ecology. (Unit III)
13. Pandeya SC et al., (1963) Principles of Environment Sciences. (Unit IV)
14. Etherington JR (1975) Environment and Plant Ecology. (Unit IV)
15. Odum EP, Barrett GW (2010) Fundamentals of Ecology. 6th Ed. (Unit I (Unit IV)

Theory Paper VIII: BBT 402- Plant Metabolism

Learning Objectives:

1. To impart the basic knowledge of different aspects of enzymology.
2. To impart basic knowledge of mechanisms on nitrogen metabolism in plants.
3. To impart the knowledge of concepts in photoperiodism and vernalization.
4. To impart the basic knowledge of synthesis and role of secondary metabolites in plants.

Total Lectures 45

Unit I: Enzymes (11)

Introduction, definition Structure and properties of Enzyme; Classification and nomenclature of enzymes; Mechanism of enzymes catalysis and inhibition -a) Lock and key hypothesis, b) Induced fit Hypothesis; Factor affecting enzyme activity: a) Temperature; b) PH; c) Substrate Concentration

Unit II: Nitrogen Metabolism (11)

Introduction of Nitrogen Metabolism; Biological nitrogen fixation, non-symbiotic and symbiotic nitrogen fixation; Nitrogen assimilation; Enzymes involved in Nitrogen fixation

Unit III: Photoperiodism and vernalization (11)

Concept of photoperiodism; SDP, LDP, Day neutral plants; Vernalization

Unit IV: Secondary metabolites (12)

Introduction of primary and secondary metabolism; Terpenoids; Phenolic compound; Nitrogen containing compound (alkaloids); Role and importance of secondary metabolites.

Learning Outcomes:

1. The students learn to explain the concept of plant metabolism.
2. The students learn to write answers and brief notes about the role of enzymes in plant physiology.
3. The students learn the concepts of photoperiodism and vernalization.
4. The students learn to explain the concepts of plant defense mechanisms through secondary metabolites.

References:

1. Hopkins, W. G. 1995. Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA. (Unit I, III)

2. Moore, T. C. 1989. Biochemistry and Physiology of Plant Hormones. (2nd edition). Springer – Verlag, New York, USA. (Unit I, III)
3. Salisbury, F. B. and Ross, C. W. 1992. Plant Physiology. (4th edition). Wadsworth Publishing Co., California, USA. 19 (Unit I, II, III, IV)
4. Taiz, L. and Zeiger, E. 1998. Plant Physiology. (2nd edition) Sinauer Associates, Inc., Publishers, Massachusetts, USA. (Unit I, II, III, IV)
5. Grewal R.C. – Plant Physiology. Campus Books International 483/24, Prahiad street Ansari Road, Darya ganj, New Delhi – 110002. (Unit I, III)
6. Jain V.K. Fundamentals of Plant Physiology. S. Chand & Company Ltd. Ramnagar, New Delhi – 110055. (Unit I, III, IV)
7. Bidwell, R.G.S. 1974. Plant Physiology. Macmillan P ub. Co., N.Y. (Unit III)
8. Pandey, S.N. (1991): Plant Physiology, Vikas Publishing House (P) Ltd., New Delhi, India. (Unit IV)

Practical Paper IV: BBP 403- Practicals based on Theory Paper VII and VIII

Learning Objectives:

1. To give practical knowledge to students about ecological factors and ecological adaptation in plants.
2. To give the practical knowledge about various physiological processes.
3. To participate students in experiential learning with these practicals.

Practicals:

Group A based on Paper VII

1. Study of Meteorological Instruments
2. Study of pH and Water Holding Capacity of different soils.
3. Study of morphological and anatomical adaptations in hydrophytes- *Hydrilla*, *Eichhornia*.
4. Study of morphological and anatomical adaptations in Xerophytes- *Aloe*, *Nerium*.
5. Study of morphological and anatomical adaptations in Epiphytes (Orchid) and Parasites, (*Cuscuta*).
6. Study of Ecological pyramids based on the field data / given data.
7. Study of Phytogeographical regions of India using standard Maps.
8. Study of estimation of hardness of water sample.
9. Study of estimation of BOD of water sample.
10. Study of plant resources used in bioremediation.
11. Evaluation of the efficacy of plants for the removal of color, reduction of heavy metals, and toxicity from textile dye effluent.

Group B based on Paper VIII

12. Study of effect of pH on dehydrogenase enzyme activity.
13. Study of effect of temperature on catalase enzyme activity.
14. Study of nitrate reductase enzyme activity.
15. Study on nitrogen fixing microorganisms (demonstration).
16. Effect of Red and far red light on growth of plants.
- 17-18. Effect of low temperature treatment on growth of plants.

19-20. Qualitative analysis of plants secondary metabolites (terpenoids, phenolics, alkaloids etc.).

Learning outcomes

The students shall learn:

1. Handling of meteorological instruments and edaphic factors.
2. About ecological principles, phytogeographical regions and adaptations in different groups of plants.
3. Use of plants in remediation.
4. Enzyme activity and its regulation.
5. Nitrogen metabolism in plants.
6. Photophysiology of plants.
7. Qualitative analysis of plants secondary metabolites.

References:

1. Sadasivam and Manickam: Biochemical Methods. New Age International Publishers.
2. Bendre A (2010) Practical Botany, Rastogi Publications.
3. Pande BP, Modern Practical Botany, Vol. I, S Chand Publishers.
4. Pande BP, Modern Practical Botany, Vol. II, S Chand Publishers.
5. Wallis CJ (1966) Practical Botany for Advanced Level and Intermediate Students (5th Ed.), William Heinemann Medical Books Ltd.